

REMARKS

By the above amendments and discussion to follow, Applicants have advanced the claims in the application to a condition for allowance. The claims presently stand rejected as being anticipated under 35 USC 102(b) and in the alternative under 35 USC 103 as being obvious over US 5,089,241, Smith.

Applicants traverse the rejection for lack of prima facie of unpatentability because the difference between the claims and prior art as a whole is neither taught nor suggested by Smith. More specifically, Smith distinctly teaches a process for removing hexafluoroarsenic acid or salts thereof from an aqueous solution by carrying out the difficult hydrolysis of hexafluoroarsenic acid or salts thereof. The hydrolysis is conducted at temperatures for 50 to 150°C. In contrast, the claims relate to a process for removing arsenic compounds from the distillation bottoms obtained in the distillation of arsenic-containing hydrogen fluoride by concentrating the distillation bottom at a low temperature, and then converting them into a landfill-disposable form by reacting them with calcium hydroxide, calcium oxide, or a mixture thereof.

While the Examiner is correct in noting that Smith discloses a temperature range of 50-150°C, said temperature range is applied in process steps that are different from those of the claimed process. In the main, this temperature range is applied at the stage of concentrating the hexafluoroarsenic acid or salts thereof (see column 6, lines 8-19). At any rate the overlap does not establish a prima facie case of unpatentability absent a disclosure of the invention as whole with sufficient specificity by Smith. Applicants submit that the claimed process of applying relatively lower temperatures to distillation bottoms cannot be envisaged from Smith.

The lack of basis for envisaging the claimed invention from Smith is discussed more fully hereunder by presenting the summary of the invention, the statement of the rejection and how the claims avoid or overcome the rejections.

Summary of the Invention

The present invention provides a process for removing arsenic compounds from the distillation bottoms obtained in the distillation of arsenic-containing hydrogen fluoride comprising

- (a) concentrating the distillation bottoms by evaporation of hydrogen fluoride until the temperature at the bottom is from 40 to 60°C (preferably from 40 to 50°C), and
- (b) reacting the residue with calcium hydroxide, calcium oxide, or a mixture thereof.

Statement of the Rejections

Claims 1, 2, and 4 stand rejected under 35 USC 102(b) as being anticipated by Smith '241 (cols. 5-8 and the Examples). Also, Claims 1-4 stand rejected under 35 USC 103(a) as being unpatentable over Smith '241 in view of the admitted prior art, on "instant pg. 3, lines 4-7". The rejection predicated on the grounds that:

"Smith teaches the instantly claimed process wherein bottoms are evaporated at 50-150° C and then treated with calcium hydroxide or calcium oxide (see col. 5-8). The instant admitted prior art states that commercial arsenic containing hydrogen fluoride has water, sulfuric acid and sulfur dioxide contents which overlap those instantly claimed and thus would have been obvious."

The Examiner's rationale for the obviousness conclusion is that one of ordinary skill in the art at the time the invention was made would have selected the overlapping proportion of the range disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness.

Hence, there is presented an issue of whether the claimed subject matter is disclosed with sufficient specificity by the alleged prior art disclosure of overlapping ranges of temperature in spite of the significant differences between the claims and Smith. It is well settled in the law that where the prior art discloses a range, which overlaps, but no specific examples falling within the range are disclosed, anticipation must be based on the prior art disclosure of the claimed invention with sufficient specificity. If the claims recite a narrow range and the prior art discloses a broad range and there is evidence of unexpected results within the claim-recited narrow

range, it is reasonable to conclude that narrow range is not disclosed with sufficient specificity to constitute anticipation of the claims. Differently put, based on the cited reference, the Examiner must provide reasons for anticipation and obviousness of the narrow range, Ex parte Lee 31 USPQ2d 1105 (Bd. Pat. App. & Inter. 1993).

Statement of How the Claims Avoid or Overcome the Rejections

As noted above, the claimed invention relates to a process for removing arsenic compounds from the distillation bottoms obtained in the distillation of arsenic-containing hydrogen fluoride (see page 2, lines 7 to 15 of the captioned application). The essential feature of the claimed invention is the concentration by distillation performed at a low temperature and the conversion into a landfill-disposable form, without eliminating the toxicity of the hexafluoroarsenic acid.

In contrast, the reference describes a process for converting hexafluoroarsenic acid or salts thereof contained in an aqueous mixture. The essential feature of the referenced process is hydrolysis of hexafluoroarsenic acid or salts thereof. The process comprises adding to the aqueous mixture sulfuric acid, arsenic acid or perchloric acid or mixtures thereof as catalysts (see column 5, lines 50 to 57 of Smith). The process further comprises raising the temperature of the aqueous mixture to 50 to 150°C before, during or after the acid addition sufficient to remove all of the hydrogen fluoride in a subsequent step. The subsequent step comprises passing an inert gas through the heated acid mixture steam in a quantity sufficient to remove substantially all of the hydrogen fluoride. Substantially all of the hydrogen fluoride is separated from the acid mixture, whereupon the hexafluoroarsenic acid or salt thereof converts substantially to arsenic acid or salts thereof. The arsenic acid is rendered non-hazardous by reacting the acid mixture with commercially available calcium oxide to form calcium arsenate. The mixture may also be reacted with a suitable alkali for neutralization and any calcium or magnesium compound that provides calcium or magnesium ion to react with arsenate. This includes calcium or magnesium hydroxides, chlorides, carbonates, oxides or combinations such as dolomites including calcium and magnesium carbonate.

From the foregoing the Examiner would agree that the claimed invention and Smith differ in many respects. First of all, claimed invention differs in that it does not relate to a process involving hydrolysis to convert hexafluoroarsenic acid or a salt thereof to arsenic acid or a salt thereof. The claimed invention differs in that it does not teach addition of a catalyst to effect hydrolysis or to break hydrogen fluoride/water azeotropes. The claimed invention differs in that it does not require passing inert gas through the heated acid mixture steam to remove substantially all the hydrogen fluoride. The claimed invention differs in that it employs calcium oxide or calcium hydroxide to convert the entire bottoms product into a crumbly, disposable product. The toxic hexafluoroarsenic acid is present in the form of the calcium salt. The claimed invention further differs in that it does not employ temperatures ranging from 50 and 150°C in distilling the bottoms-product.

Apparently, the Examiner is contending that reference temperature range of 50 -150°C applied to the aqueous mixture overlaps the claim-recited temperature range 40 to 60°C which is applied to the distillation bottoms. In point fact, the claimed and referenced temperatures are at different stages of the process. Therefore, anticipation cannot be based thereon. At any rate, for the overlap to constitute a basis for unpatentability, the reference must disclose the claimed invention as a whole with sufficient specificity. That is the reference must show that the skilled artisan would have envisaged the claimed invention from the disclosure. In this case, there is no basis in the reference for inferring the claimed invention. And, given Smith's teaching that if the reaction temperature of the reaction mixture is below 75°C, the amount of hydrogen fluoride removed is inadequate (see col. 7, lines 55-56), one would be hard pressed to argue that Smith provides disclosure of sufficient specificity leading to the claim recited temperature range of 40 to 60°C.

To be sure, the process step of concentration (step a) of claim 1) is known from the prior art. However, the low temperatures employed in the claimed invention are critical from the point of view of process engineering when distilling corrosive media. High temperatures are technically not practicable, since they place very high demands on the materials employed. This and other disadvantages of the

referenced process are discussed hereunder to show that the referenced process would not have taught or suggested the claims. W.L Gore & Associates, Inc. v. Garlock Inc. 220 USPQ 303 (Fed. Cir. 1983). The referenced process for working up the hydrogen fluoride containing hexafluoroarsenic acid has several disadvantages. The removal by distillation of the main quantity of the hydrogen fluoride results in a bottoms product which is composed of hydrogen fluoride with high contents of sulfuric acid, hexafluoroarsenic acid and water, which is therefore highly corrosive and thus requires the use of special apparatus. The bottoms product is concentrated by evaporation in a second working step at 50 to 150°C, and particularly preferably at 70 to 105°C, to form a highly corrosive aqueous mixture, in which the concentration of hexafluoroarsenic acid is about 40 to 60% by weight. This process requires plastics-lined apparatus, additional problems arising at the required high temperatures due to the high rate of diffusion of hydrogen fluoride through the plastic lining (see also column 6, lines 49 to 55). Despite significant outlay for the referenced complicated process requiring hydrolysis of hexafluoroarsenic cation, the resulting sparingly soluble arsenate-containing residue has to be deposited in a landfill for hazardous waste.

In contrast, the claims recite a facile but effective process wherein distillation bottoms obtained in the purification of hydrogen fluoride by distillation can be converted directly into a product capable of disposal in a landfill by reaction with calcium hydroxide, calcium oxide or a mixture thereof.

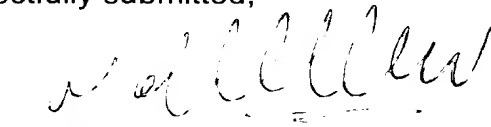
Net: There is no evidence or practical reason of record which would have led the skilled artisan to make the series of inferences leading to the claims. Namely, the skilled artisan would have to first infer modifying Smith's process by eliminating the hydrolysis step. Then the skilled artisan would have to infer that the higher temperature range for concentrating hexafluoroarsenic acid could have been modified to lower temperatures for concentrating hydrogen fluoride in distillation bottom. Further, the skilled artisan would have to infer modifying the referenced process by eliminating the step of passing inert gas through the acid mixture and separating the hydrogen fluoride, and substituting therefor the step of reacting the

bottoms product (instead of arsenic acid or arsenate) with calcium products. Surely, the Examiner would agree that the record is devoid of bases for these series of inferences.

In view of the foregoing arguments, Applicants submit that the claims are patentable over the prior art. The claims as amended are in a condition for allowance and Applicants pray for their allowance.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE:

IN THE CLAIMS

1. A process for removing arsenic compounds from the distillation bottoms obtained in the distillation of arsenic-containing hydrogen fluoride comprising
 - (a) concentrating ~~the~~ distillation bottoms by evaporation of hydrogen fluoride until the temperature at the bottom is from 40 to 60°C, and
 - (b) reacting the resulting residue with calcium hydroxide, calcium oxide, or a mixture thereof.

4. A process according to Claim 1 wherein the amount of calcium hydroxide, calcium oxide, or mixture thereof corresponds to the amount necessary for stoichiometric conversion of the distillation bottoms comprising products selected from the group consisting of sulfuric acid, hydrofluoric acid, and hexafluoroarsenic acid into the corresponding calcium compounds.